1. Let us negate the goal and assume the negated goal is true to prove the contrapositive. The negated goal would be “ an NP-complete problem that has a algorithm.” Since any NP-complete problem can be reduced to any other NP-complete problem, SAT can be reduced to in polynomial time, and so we could solve SAT through such a reduction. The total time associated with such a reduction plus the time to solve is , where means polynomial time in , which we can express as , where is a natural number. We now need to show is . is anyway, so we can ignore it, and is still , so we only need to show is . The two sides have the same base (), so we only **need to show is .**

If a function is , that by definition means as approaches infinity, approaches 0, which means approaches . thus approaches as approaches infinity. To show that is , we need to show as approaches infinity, approaches . We already showed that as approaches infinity, the numerator approaches ; and it’s obvious that the denominator approaches infinity, so approaches . is thus , and so is . So has a algorithm. The contrapositive is thus proven. QED.